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G4H

G4M

Selected US specifications from IPC sub-class G06K

(54) **Low-profile bar code scanner**

(57) A bar code scanner provides at least one set of line scans (32a-f) which are tilted with respect to a plane (18) of movement of an object (140) bearing the bar code (142) and a set of line scans (34a-f) perpendicular to that plane.

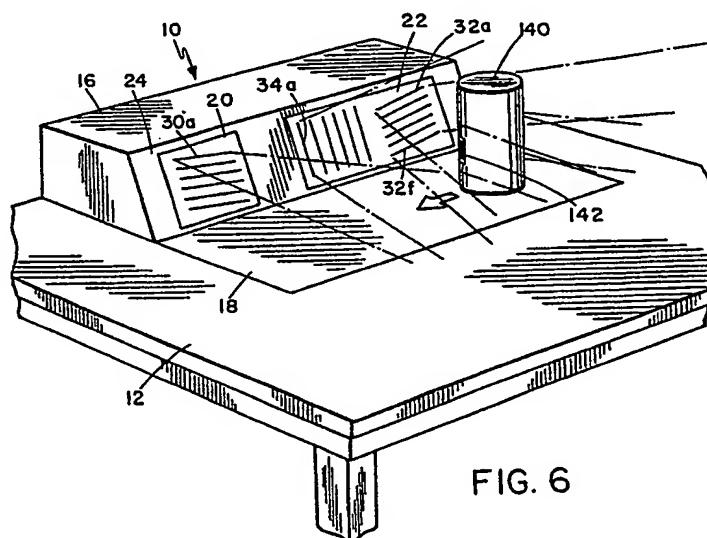


FIG. 6

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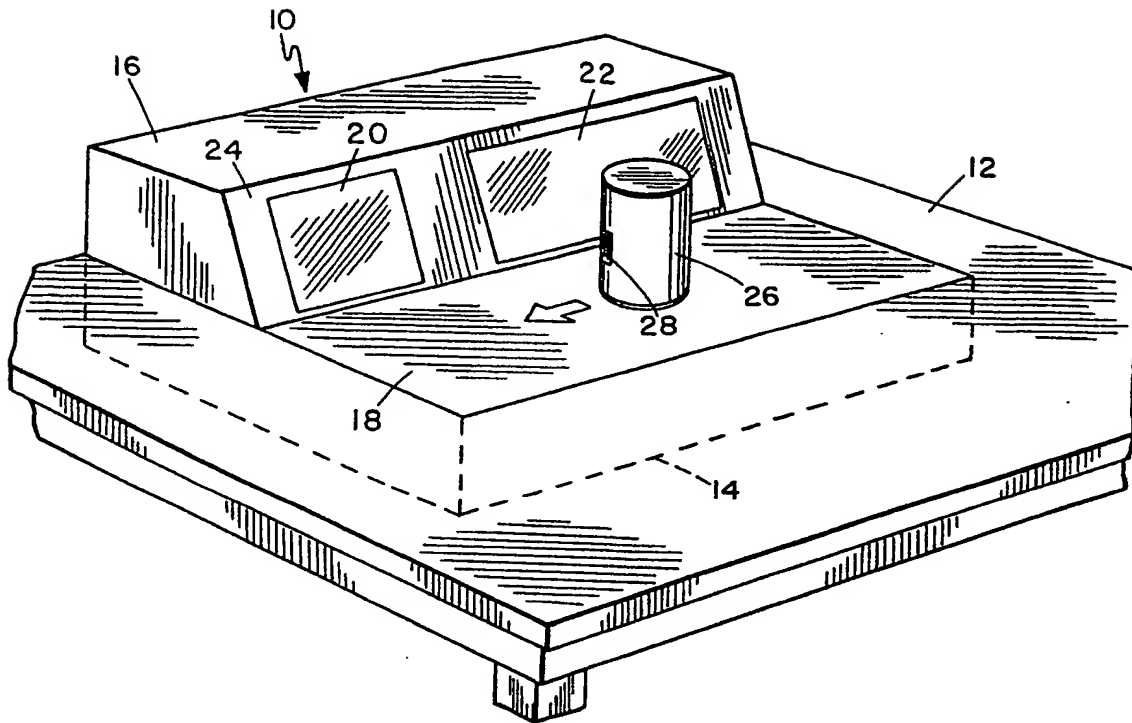


FIG. 1

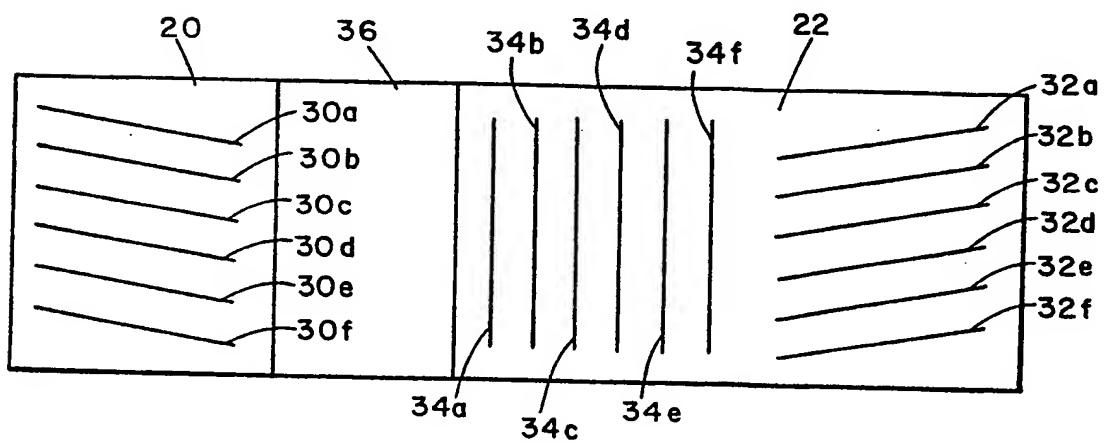


FIG. 2

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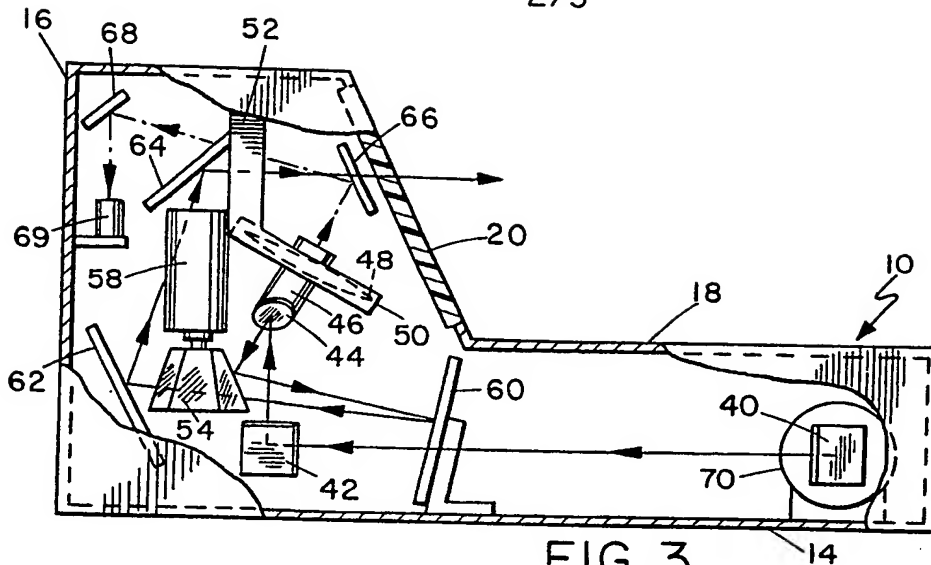


FIG. 3

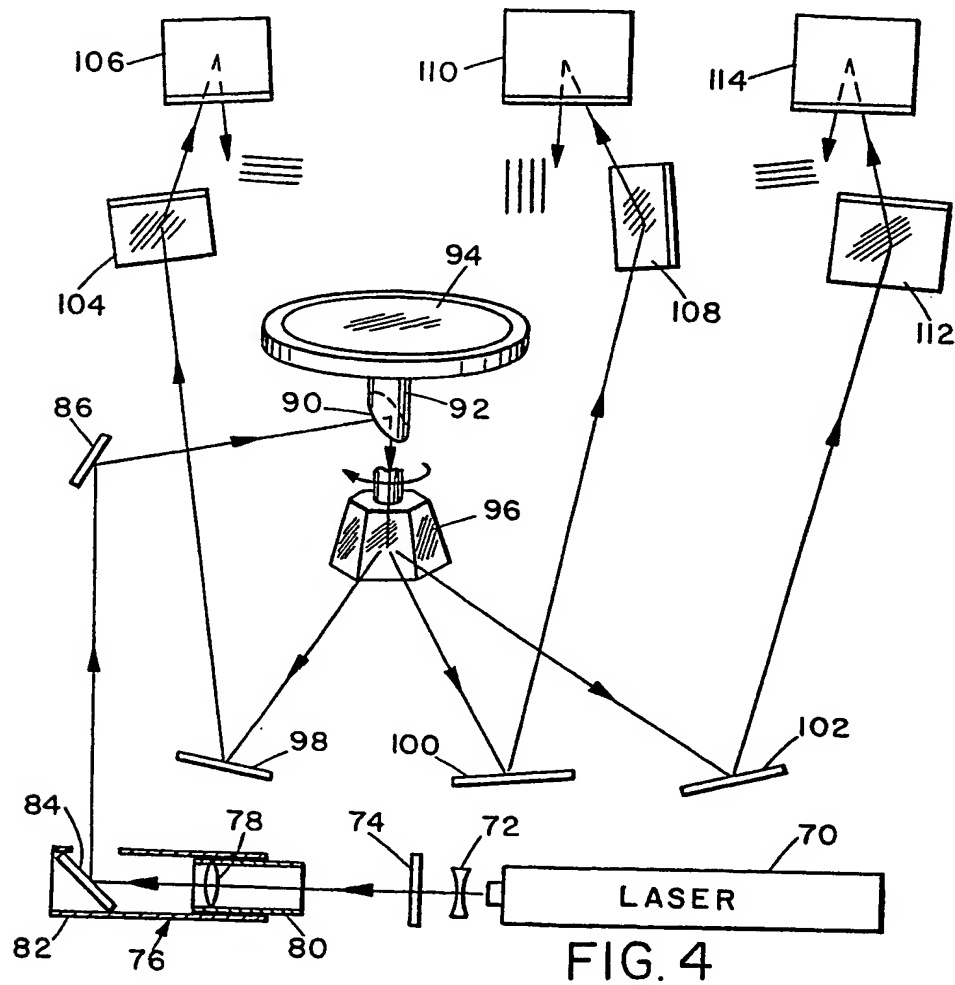
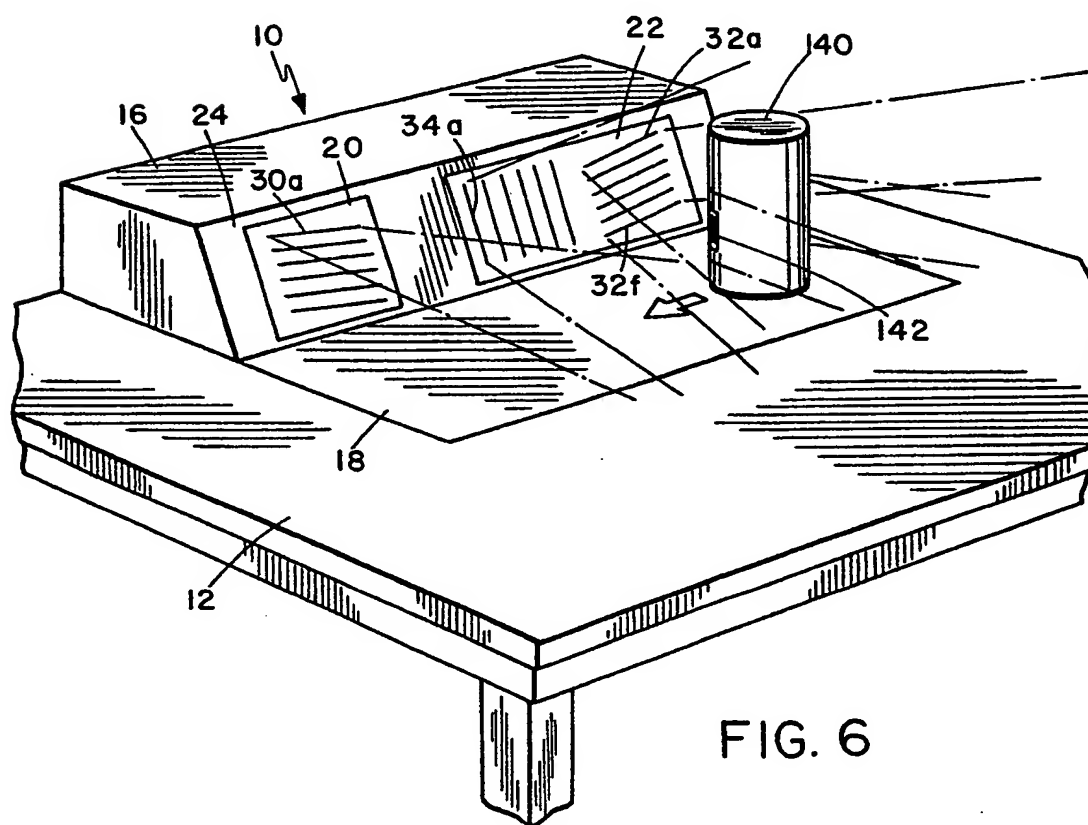
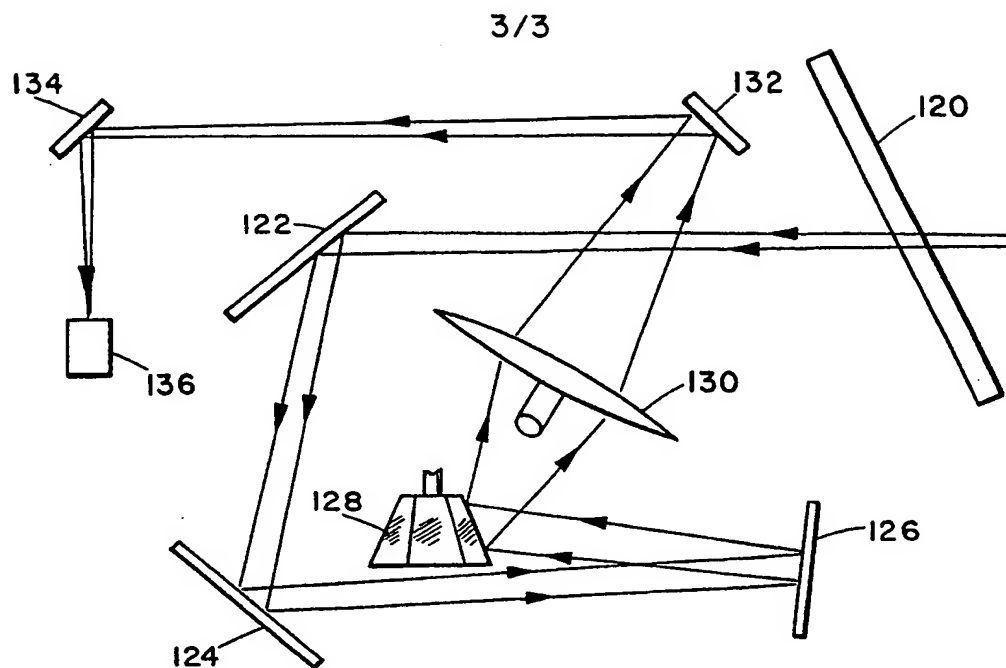


FIG. 4



SPECIFICATION

Low-profile bar code scanner

5 *Background of the invention*

The present invention relates to a novel and improved apparatus for scanning bar code indicia used on packages to identify products. More specifically, the present invention relates to a compact, low-

10 profile bar code scanner utilising a novel side scanning technique.

Systems have previously been developed to scan the conventional bar code coded indicia, commonly referred to as UPC indicia. Such systems have previously fallen into two separate categories, handheld systems or the conventional top or bottom scanning systems. Both systems are commonly used in check-out stations in supermarkets and other retail stores where the UPC symbols encoded onto the package are scanned. The UPC coded information detected from the product is then fed to a computer which generates the price to be charged the customer for the item.

In many applications the portable handheld scanner is rather a disadvantageous tool for reading the UPC code. In applications such as supermarkets, the handheld unit would require a supermarket counter-clerk to locate the UPC code by moving the product with one hand while holding the scanner head in the other. Such use of a handheld scanner is cumbersome for the operator.

The more typical scanners employed in the supermarkets are the bottom scanning units which require the operator to draw the UPC coded item across the scanner window typically located in the check-out countertop. Several disadvantages accompany the bottom scanning systems, one such disadvantage being that the window may become scratched or dirty. Supermarket personnel must periodically clean from the window spilled liquids or debris from dropped merchandise. In many cases, window replacement is required and can be an expensive procedure in those systems that use sapphire coated glass windows. Another disadvantage with the bottom scanning units is that the scanning hardware and electronics are typically located in the area beneath the window. Therefore, the space in the counter area beneath the scanner window must be reserved for the scanner hardware. In applications where the clerk desires to sit down there would be no room for the clerk's legs beneath the scanning window. Such positioning of the clerk would cause discomfort for the clerk in attempting to operate the scanner by sitting at the side of the scanner.

55 It is therefore an object of the present invention to provide a new and improved bar code scanner.

It is a more particular object of the present invention to provide a bar code scanner which permits access beneath the countertop where the scanner is located.

It is a further more particular object of the present invention to provide a bar code scanner which substantially reduces scanner window maintenance and replacement.

65 It is a detailed object of the present invention to

provide a bar code scanner with reduced adjustment requirements of scanner mirrors.

70 It is still a further particular object of the present invention to provide a bar code scanner which permits continuous yet comparatively safe laser operation.

Summary of the invention

According to a broad aspect of the invention there is provided apparatus for reading a bar code on an object and including means defining for a light beam an optical scan in substantially parallel planes inclined relative to a predetermined plane of movement of the object such that a line scan of the beam on the object moves substantially perpendicularly to the said plane of movement as the object moves.

In a particular preferred form the apparatus includes a housing having a base portion and a window portion with the window portion being mounted above a rear section of the base portion. A forward section of the base portion has a flat top surface while the window portion has an optically transmissive window mounted in a side facing the top surface. The region above the top surface and adjacent the window defines a scanning region. Means are mounted within the housing for generating first, second and third scan patterns each comprised of a plurality of substantially parallel spaced apart light scan lines. The first scan pattern scans lines each enter the scanning region through the window at planes each at a predetermined angle from planes parallel to the top surface. The third scan pattern scan lines each enter the scanning region through the window at planes each as a second predetermined angle from planes parallel to the top surface. The second scan pattern scan lines each enter the scanning region through the window at planes each substantially perpendicular to the plane at the top surface. The second scan pattern scan lines are oriented along the window for entering the scanning region between the first and second scan patterns scan lines. Means are included for detecting light reflected from the bar code affixed to an object being scanned within the scanning region back through the window. The means for detecting light detects the reflected light having at least a predetermined intensity and provides an electrical signal in response thereto. Means are included for directing the reflective light from a bar code affixed to an object within the scanning region to the means for detecting light.

Brief description of the drawings

Figure 1 illustrates one embodiment of the bar code scanner of the present invention inset in a countertop;

Figure 2 represents the laser beam scanning pattern which occurs at the scanning windows;

Figure 3 is a side elevation view of the bar code scanner, with portions cut away and showing the mirrors of a single optical path;

Figure 4 is a schematic illustration of the laser scanning system including the optical path;

Figure 5 is a schematic illustration of the detection of a return signal in a single optical path; and

130 Figure 6 illustrates an object being scanned by a

CLAIMS

1. Apparatus for reading a bar code on an object and including means defining for a light beam an optical scan in substantially parallel planes inclined relative to a predetermined plane of movement of the object such that a line scan of the beam on the object moves substantially perpendicularly to the said plane of movement as the object moves.
2. Apparatus according to claim 1, further comprising means for providing an additional scan in substantially parallel planes disposed substantially perpendicularly to the said plane of movement.
3. Apparatus according to claim 1 or 2 in which the plane of movement is defined by a substantially flat countertop.
4. An apparatus for scanning a bar code affixed to an object and providing an electrical signal indicative of the scanned bar code, comprising:
 - a housing having a base portion and a window portion, said window portion mounted above a rear section of said base portion with the forward section of said base portion having a flat top surface, said window portion having an optically transmissive window mounted in a side facing said top surface, the region above said top surface and adjacent said window defining a scanning region;
 - means mounted within said housing for generating first, second and third scan patterns each comprised of a plurality of substantially parallel spaced apart light scan lines, wherein said first scan pattern scan lines each entering across said a first predetermined angle from planes parallel to said top surface, said third scan pattern scan lines each entering across said scanning region through said window at planes each at second predetermined angle from planes parallel to said top surface, said second scan pattern scan lines each entering said scanning region through said window at planes each substantially perpendicular to the plane of said top surface, said second scan pattern scan lines oriented along said window for entering said scanning region between said first and third scan pattern scan lines;
 - means for detecting light reflected from the bar code affixed to an object being scanned within said scanner region, back through said window, said reflected light having at least a predetermined intensity, and said means for detecting light providing an electrical signal in response thereto; and
 - means for directing said reflected light from a bar code affixed to an object within said scanning region to said means for detecting light.
 5. Apparatus according to claim 1 wherein said first and third predetermined angles are respectively in the range of 10° to 35° so as to converge inwardly and downwardly with respect to said top surface.
 6. The apparatus of claim 2 wherein said first and third scan pattern scan lines enter said scanning region upwardly and outwardly from said window at a predetermined angle from planes parallel to the plane of said top surface.
 7. A compact, low-profile, side scanning bar code scanner comprising:
 - a housing having a base portion and a window portion, said window portion mounted above a rear section of said base portion with the forward section of said base portion having a flat top surface, said window portion having an optically transmissive window mounted in a side facing said top surface, the region above said top surface and adjacent said window defining a scanning region;
 - means for generating a coherent beam of light mounted within said housing;
 - a polygon-shaped spinner mounted within said housing, said spinner having a plurality of reflecting surfaces thereon, each surface positioned about a different angle with respect to a common axis;
 - means mounted within said housing for rotating said spinner at a predetermined rotation rate;
 - means mounted within said housing for directing said beam of light to each reflective surface of said spinner, one at a time as said spinner is rotated;
 - first reflecting means mounted within said housing for generating in response to said beam of light reflecting from said spinner a first scan pattern including a plurality of substantially parallel spaced apart light scan lines;
 - second reflecting means mounted within said housing for generating in response to said beam of light reflecting from said spinner a second scan pattern including a plurality of substantially parallel spaced apart light scan lines;
 - third reflecting means mounted within said housing for generating in response to said beam of light reflecting from said spinner a third scan pattern including a plurality of substantially parallel spaced apart light scan lines;
 - wherein said first scan pattern scan lines each entering said scanning region through said window at planes each at a first predetermined angle from planes parallel to said top surface, said third scan pattern scan lines each entering said scanning region through said window at planes each at second predetermined angle from planes parallel to said top surface, said second scan pattern scan lines each entering said scanning region through said window at planes each substantially perpendicular to the plane of said top surface, said second scan pattern scan lines oriented along said window for entering said scanning region between said first and third scan pattern scan lines;
 - means for detecting light reflected from the bar code affixed to an object being scanned within said scanner region, back through said window, said reflected light having at least a predetermined intensity, and said means for detecting light providing an electrical signal in response thereto; and
 - means for directing said reflected light from a bar code affixed to an object within said scanning region to said means for detecting light.
 8. A scanner according to claim 7 wherein said first and third predetermined angles are respectively in the range of 10° to 35° so as to converge inwardly and downwardly with respect to said top surface.
 9. A scanner according to claim 8 wherein said first and third scan pattern scan lines enter said scanning region upwardly and outwardly from said window at a predetermined angle from planes parallel to the plane of said top surface.

10. A scanner according to claim 8 wherein said means for generating a coherent beam of light comprises;

a laser mounted in said forward section of said base;

a negative lens mounted adjacent the light output of said laser within said forward section;

an optical attenuator mounted adjacent said negative lens within said forward section;

a positive lens mounted within an inner holder, said inner holder slidably mounted within and at one end of an outer holder mounted within said forward section;

a mirror mounted at the other end of said outer holder, said outer holder having a hole in a side facing the rearward section of said base;

wherein said laser, said negative lens, said optical attenuator, said positive lens and said mirror are optically aligned.

11. A scanner according to claim 7 wherein said means for rotating is a motor coupled to a bracket mounted to a top panel of said window portion and having a downwardly extending shaft having said spinner mounted thereon.

12. A scanner according to claim 7 wherein each surface of said spinner reflects said beam of light respectively through said first, second and third reflecting means, with each surface of said spinner generating a predetermined scan line of each of said first, second and third scan patterns.

13. A scanner according to claim 7 wherein said first reflecting means comprises:

a primary mirror mounted in said rearward section of said base facing said spinner;

a secondary mirror mounted in said rearward section adjacent of said base adjacent a rear panel;

a tertiary mirror mounted in said window portion; and

wherein said beam of light is reflected from said spinner across the face of said primary mirror, said primary mirror reflecting said beam of light across the face of said secondary mirror, said secondary mirror reflecting said beam of light across the face of said tertiary mirror and said tertiary mirror reflecting said beam of light through said window as scan lines in said first scan pattern.

14. A scanner according to claim 7 wherein said second reflecting means comprises:

a primary mirror mounted in said rearward section of said base facing said spinner;

a secondary mirror mounted in said rearward section adjacent of said base adjacent a rear panel;

a tertiary mirror mounted in said window portion; and

wherein said beam of light is reflected from said spinner across the face of said primary mirror, said primary mirror reflecting said beam of light across the face of said secondary mirror, said secondary mirror reflecting said beam of light across the face of said tertiary mirror and said tertiary mirror reflecting said beam of light through said window as scan lines in said second scan pattern.

15. A scanner according to claim 7 wherein said third reflecting means comprises:

a primary mirror mounted in said rearward section

of said base facing said spinner;

a secondary mirror mounted in said rearward section adjacent of said base adjacent a rear panel;

a tertiary mirror mounted in said window portion; and

wherein said beam of light is reflected from said spinner across the face of said primary mirror, said primary mirror reflecting said beam of light across the face of said secondary mirror, said secondary mirror reflecting said beam of light across the face of said tertiary mirror and said tertiary mirror reflecting said beam of light through said window as scan lines in said third scan pattern.

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